

# Kodaikanal Observatory.

## BULLETIN No. CIII.

### SUMMARY OF PROMINENCE OBSERVATIONS FOR THE FIRST HALF OF THE YEAR 1933

In pursuance of the programme of work adopted since 1st January 1923 under the auspices of the International Astronomical Union, all observatories taking spectroheliograms of the sun have been asked to co-operate with the Kodaikanal Observatory by supplying copies of their photographs for those days when the Kodaikanal records are imperfect or wanting. In response to our requirements for the first half of the year 1933, the Mount Wilson Observatory supplied calcium ( $K_{85}$ ) prominence plates for 25 days,  $H\alpha$  disc plates for 5 days and the Meudon Observatory supplied calcium ( $K_8$ ) disc plates for 7 days and  $H\alpha$  disc plates for 30 days.

When only incomplete or imperfect photographs for any day are available from more than one observatory, the best photograph is chosen as representing the solar activity of that day, after weighting it according to its quality, and the remaining photographs are ignored.

*Calcium Prominences at the Limb.*—The mean daily areas and numbers of prominences photographed during the half-year by means of the K line of calcium are given below. The means are corrected for incomplete or imperfect observations, the total of 180 days for which plates were available being reduced to 167 effective days.

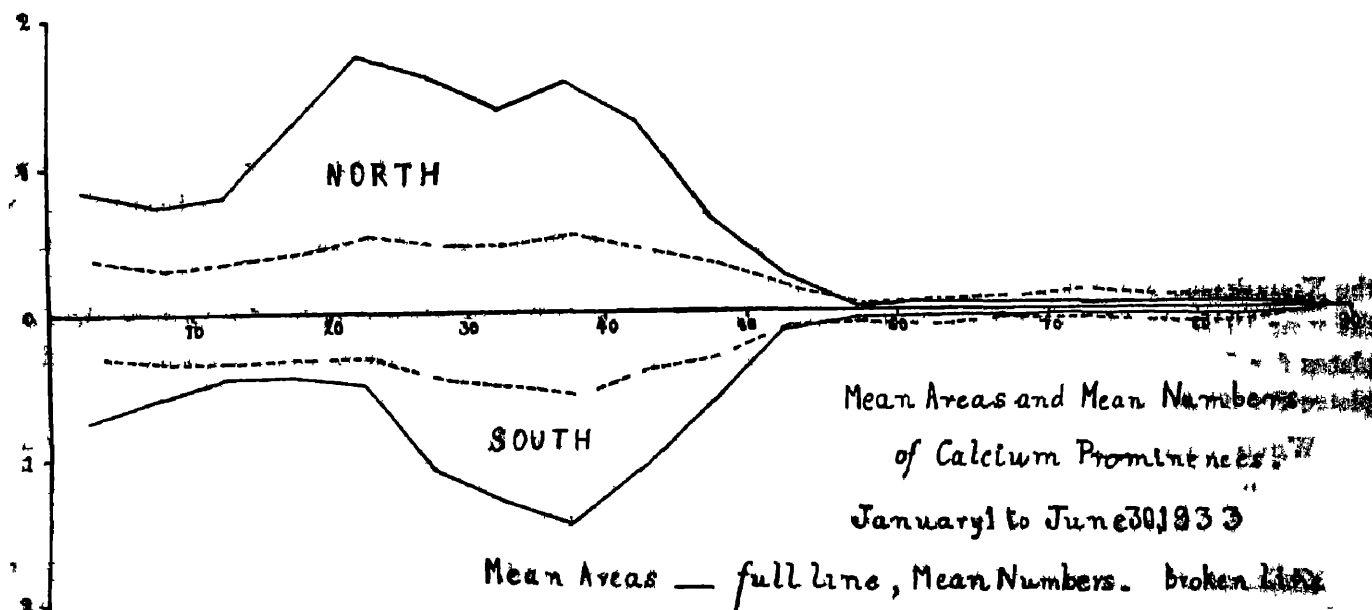
								Mean daily areas (square minutes).	Mean daily numbers.
North	...	...	...	...	...	...	...	1'25	4'92
South	...	...	...	...	...	...	...	0'83	4'29
								2'08	9'21
								2'08	9'21

Compared with the previous half-year, areas and numbers show an increase of 20 per cent and 10 per cent, respectively.

For comparison with bulletins issued prior to the co-operation of other observatories, the means based on Kodaikanal photographs alone are also given, 166 days of observation being counted as  $148\frac{1}{2}$  effective days.

								Mean daily areas (square minutes).	Mean daily numbers.
North (Kodaikanal photographs only)	..	...	.					1'28	5'07
South ( do. )	..	...	...					0'89	4'50
								2'17	9'57
								2'17	9'57

The distribution of prominences in latitude is represented in the following diagram, in which the full line gives the mean daily areas and the broken line the mean daily numbers for each zone of 5° of latitude. The ordinates represent tenths of a square minute of arc for the full line and numbers for the broken line. Compared with the previous half year there has been an increase of activity in the northern hemisphere near 20°, and in the southern hemisphere near 40°.



The monthly, quarterly and half-yearly areas and numbers and the mean height and mean extent of the prominences on photographs from all co-operating observatories are given in Table I. The unit of area is 1 square minute of arc. The mean height is derived by adding together the greatest heights reached by individual prominences and dividing by the total number of prominences observed, the mean extent is derived by adding together the lengths of the base on the chromosphere of individual prominences and dividing by the total number of prominences —

TABLE I.—ABSTRACT FOR THE FIRST HALF OF 1933

Months	Number of days (effective)	Areas	Numbers	Daily means		Mean height	Mean extent.
				Areas	Numbers		
1933							
January	28	57.7	262	2.1	9.4	41.6	4.74
February	27½	46.8	265	1.7	9.7	34.4	4.36
March	30½	58.3	290	1.9	9.6	35.6	4.70
April	27½	74.1	266	2.7	9.7	40.9	4.96
May	26½	48.7	222	1.8	8.3	36.5	4.64
June	27	62.1	232	2.3	8.6	43.2	5.11
First quarter	85½	162.3	817	1.9	9.6	37.1	4.60
Second quarter	81½	184.9	720	2.3	8.8	39.3	4.69
First half	167	347.2	1,537	2.1	9.2	38.2	4.64

*Distribution East and West of the Sun's Axis.*—As in the previous half-year, areas show a slight defect and numbers an excess at the east limb as will be seen from the following table.—

1933 January to June				East.	West.	Percentage East.
Total number observed	.	...	...	790	747	51.40
Total areas in square minutes		...	...	171.2	176.0	49.30

*Hydrogen Prominences at the Limb.*—During the half-year, photographs of the prominences in hydrogen light were taken at this observatory on 157 days which were counted as 141 effective days. The mean daily areas of hydrogen prominences in square minutes of arc are given below —

								Mean daily areas (square minutes)
North	..	...	..	..	..	..	..	0.64
South	..	.	.	...	.	..	...	0.45
Total								1.09

Compared with the previous half-year, H $\alpha$  prominence areas show an increase of 76 per cent. The ratio of H $\alpha$  areas to calcium areas is 52 per cent, a considerable increase over the previous half-year. The curve of H $\alpha$  prominences is intermediate between those of calcium prominences and H $\alpha$  absorption markings.

*Metallic Prominences.*—Three metallic prominences were observed during the half-year. The details are given below :—

TABLE II.—LIST OF METALLIC PROMINENCES.

Date.	Time I.S.T.	Base.	Latitude.		Limb.	Height	Lines
			North.	South.			
1933	H. M.	°	°	°		"	
January 2	.. 8 50	1	85		W	35	4924 1, 5016, b <sub>4</sub> , b <sub>3</sub> , b <sub>2</sub> , b <sub>1</sub> , 5234.8, 5316 8, D <sub>2</sub> , D <sub>1</sub> , and 6677
3	.. 9 35	1	95		E	10	4924 1, 5016, 5018.6, b <sub>4</sub> , b <sub>3</sub> , b <sub>2</sub> , b <sub>1</sub> , 5234 8, 5276 2, 5316 8, 5363 0, D <sub>2</sub> , D <sub>1</sub> , 6677 and 7065
14	... 9 59	3	...	95	W	15	4924 1, 5016, 5018 6, b <sub>4</sub> , b <sub>3</sub> , b <sub>2</sub> , b <sub>1</sub> , 5197 5, 5206.2, 5208 7, 5234 8, 5269 7, 5270 6, 5276 2, 5284 3, 5316 8, 5336 9, 5363 0, D <sub>2</sub> , D <sub>1</sub> and 6677

*Displacements of the Hydrogen Line.*—Particulars of the displacements observed in the chromosphere and prominences are given in the following table :—

TABLE III.—DISPLACEMENTS OF THE HYDROGEN LINE.

Date.	Time I.S.T.	Latitude.		Limb.	Displacement.			Remarks.
		North.	South.		Red.	Violet.	Both ways	
1933.	H. M.	°	°		A	A.	A.	
January 1	8 55		18.0	W	0.5			In chromosphere
2	9 02	46.0		E	0.5			Do.
	8 50	85		W	1.0			At top.
3	9 14		48.0	E		Slight		Do
4	11 17	86.0		W			1.0	To violet at top and to red at base.
13	9 08		42.0	E	0.5			In chromosphere.
14	10 06		42.0	W			1.0	At top.
	9 38	8.0		W	1.0			Do
	9 31	8.0		W			1.0	At base.
	9 31	11.0		W			0.5	Do.
22	8 28	38.0		W	0.5			At top
26	9 15	3.0		E			1.0	At base
30	9 05	28.0		E	0.5			At top
	8 55		16.0	W	Slight			In chromosphere.

TABLE III—DISPLACEMENTS OF THE HYDROGEN LINE—cont

Date	T m I S T		L t t u d		L i m b	D i s p l a c e m e n t			R e m a r k s
			N r t h.	S t h.		R e d	V o l t	B t h w y s	
1933	H	M				A	A	A	
February	1	10 51	15 0		E		Slight	6 0	At top D
	2	10 57	15 0		E	0 5			At bas
		9 18	15 0		E		1 0		At top
		9 19	12 0		E				D
		9 03	1 0		W	0 5			D
	4	11 17	7 5		W	0 5			D
	6	8 45	34 5		W	0 5			In chr m spher
	8	8 59	63 5		W	0 5			D
	10	9 19		14 0	W	0 5			At top
	12	9 16	1 0		W		Slight		In ch m spher
	13	9 10	9 5		W	1 0			At top
	17	8 45	13 0		W	1 0			Do
		8 38	49 5		W	Slight			In hr mosph
	18	8 51	70 5		W	0 5			D
	20	9 39	56 5		W		Slight		D
	21	8 58	78 5		W	0 5			D
	22	9 40		41 5	E	Slight			D
		9 57	75 5		W	2 0			At top
	23	9 12	21 0		E	0 5			At bas
	25	9 18	48 0		E	1 5			At top
	26	8 35	53 5		W	0 5			Do
March	1	9 13	35 5		W	1 0			At top
	4	9 19		12 5	E	0 5			D
	5	9 14	75 5		E	Slight			D
	6	9 30		13 5	W	Slight			At bas
	7	8 48		37 5	W	0 5			At top
	17	9 07		40 5	E	0 5			D
		8 51	66 0		W	0 5			I chrom sph re
	19	8 50		83 0	E	0 5			At t p
	20	9 24	66 0		W		Slight		I chr mo sphere
	25	10 47	23 0		E	Slight			D
		10 51	8 0		E		2 5		At top
		10 51	5 0		E	1 5			At bas
April	3	9 3		14 0	E		1 0		At top
	7	9 10		53 5	E		0 5		In chr mosphere
		8 55	39 5		W	0 5			At t p
	12	8 49		6 0	E	0 5			At b e
		8 50		12 0	E		0 5		D
	13	11 15		78 5	E	0 5			I chromo ph e
	18	8 48		21 0	W		Slight		Do
	21	8 48	17 0		W	Slight			D
	24	9 04	76 0		E		0 5		D
	28	9 11	44 0		E		0 5		At top
		9 12	35 0		E		1 0		D
	30	8 50	12 5		W	1 5			Do
May	10	9 08	32 0		E	0 5			At top
		9 30	16 0		E		0 5		At base
		9 21	38 0		W	1 0			At top
June	8	10 12		20 0	E		1 0		At top
	14	8 58		40 0	E		Slight		Do

The total number of displacements was 64 as against 25 in the previous half year and their distribution was as follows —

	North	South
1 —30°	22	10
31 —60	13	8
61 —90°	9	2
	—	—
Total	44	20

East limb	.	...	...	...	..	.	..	31
West limb	.	...	...	..	...	...	...	33
								—
						Total	...	64
								—

Of these displacements 41 were towards the red, 21 towards the violet and 2 both ways simultaneously.

*Reversals and Displacements on the Sun's Disc.*—Seventy-seven bright reversals of the H $\alpha$  line, 67 dark reversals of the D $\beta$  line and 3 displacements of the H $\alpha$  line were observed during the half-year. Their distribution is given below:—

					North	South	East	West
Bright reversals of H $\alpha$	...	...	..	...	77	.	34	43
Dark reversals of D $\beta$	..	...	...	...	67	..	31	36
Displacements of H $\alpha$		...	..	.	3	.	1	2

Two displacements were towards the red and one towards the violet.

*Prominences projected on the Disc as Absorption Markings.*—Photographs of the sun's disc in H $\alpha$  light were available from Kodaikanal and the co-operating observatories for a total of 180 days, which were counted as 175½ effective days. The mean daily areas of H $\alpha$  absorption markings (corrected for foreshortening) in millionths of the sun's visible hemisphere and their mean daily numbers are given below:—

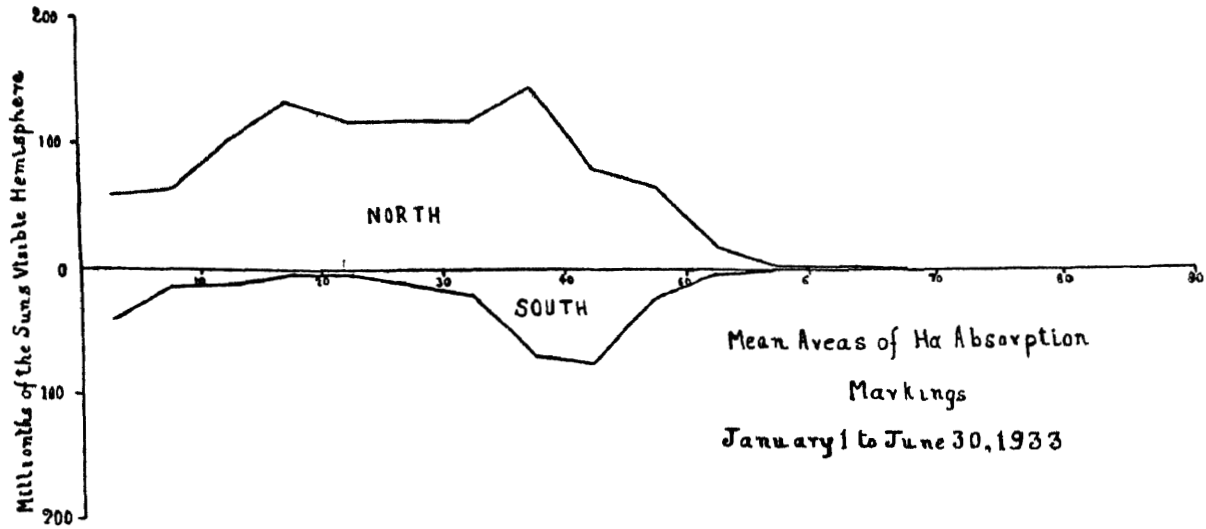
						Mean daily areas	Mean daily numbers
North	...	...	...	..	...	995	6.34
South	...	...	.	...	...	292	2.20
						—	—
					Total	1,287	8.54
						—	—

The above show an increase of 46 per cent in areas and 40 per cent in numbers, compared with the previous half-year.

For comparison with bulletins issued prior to the co-operation of other observatories, the means based on Kodaikanal photographs alone are also given, 157 days of observation being reckoned as 149½ effective days.

						Mean daily areas	Mean daily numbers
North (Kodaikanal photographs only)	...	...			...	945	5.96
South ( Do. do. do. )	...				...	281	2.14
						—	—
					Total	1,226	8.10
						—	—

The distribution of the mean daily areas in latitude is shown in the following diagram. The distribution is almost uniform in the northern hemisphere. Compared with the previous half-year there is, in the northern hemisphere, an increase in all latitudes up to 50°, whilst in the southern hemisphere there is a notable increase in the belt 0°—5°.



As in the previous half year, both areas and numbers show an eastern preponderance, the percentage for both being 51. The areas of H $\alpha$  absorption markings uncorrected for foreshortening are given below —

	Mean daily areas
North	539
South	164
	—
Total	703
	—

The uncorrected areas amount to 55 per cent of the corrected ones, almost the same as for the previous half-year

The curve of distribution in latitude is similar to that for the corrected areas as usual

Thanks are due to the co operating observatories for the photographs supplied by them

KODAIKANAL,  
20th January 1934

T ROYDS,  
Director, Kodaikanal Observatory